HIGH-ENERGY PHYSICS DATA

WHERE DATA COME FROM, WHERE THEY NEED TO GO

In their quest to understand the fundamental nature of matter and energy, Fermilab scientists study elementary particles. These particles come from two principal sources, powerful accelerators and the cosmos, and their interactions with each other and surrounding matter are captured in multi-component particle detectors with up to millions of read-out channels.

Fermilab's four-mile particle accelerator ring, the Tevatron, circulates protons and antiprotons at high speeds — and high energies — in opposite directions. When the two beams collide head-on at the centers of designated detector zones, the debris — fast-moving elementary particles — leave tracks and deposit energy in specially designed materials as they exhaust their brief existence under the detector's watchful eye.

Neutrino experiments also gather data from particle tracks. Scientists study changes in these particles' properties after the neutrinos exit Fermilab's accelerator at high energies and travel hundreds of miles to reach a detector.

Astrophysics experiments at Fermilab investigate dark matter, dark energy and high-energy cosmic rays from the sun, and map the skies in 3D.

Fermilab scientists pursue data-intensive scientific endeavors involving collaborators and experimental facilities at Fermilab, CERN and other institutions worldwide. Fermilab's Computing Division develops and supports innovative and cutting-edge computing, storage and data transfer solutions that allow the global high-energy physics community to access data and contribute to discoveries.

SOPHISTICATED SOFTWARE MUST QUICKLY PROCESS SIGNALS FROM UP TO MILLIONS OF READ-OUT CHANNELS ON A DETECTOR, EACH RECEIVING MILLIONS OF SIGNALS A SECOND.

COLLABORATIVE COMPUTING

CONNECTING VIA THE GRID

High-energy physicists from all over the world collaborate to analyze data from Fermilab experiments. Fermilab's Computing Division supports their research by providing computing and data storage resources and contributing to nationally and globally distributed grids.

FermiGrid - A CAMPUS GRID

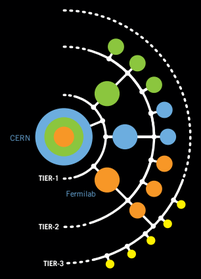
This grid provides a uniform interface to on-site Fermilab computing and storage resources used by scientists across the laboratory. FermiGrid also supports off-site users through its membership in the Open Science Grid.

Open Science Grid - A NATIONAL GRID

The OSG integrates distributed resources across more than 60 labs and universities in the U.S. into a reliable, coherent, shared cyberinfrastructure. It provides the U.S. contribution to the Large Hadron Collider's Worldwide LHC Computing Grid (WLCG). Initially driven by the needs of the CMS and ATLAS experiments at the LHC, the OSG has expanded to support data-intensive research in many fields such as genetics and meteorology.

- THE WORLDWIDE LHC COMPUTING GRID

The experiments at the Large Hadron Collider have built a globally distributed, tiered grid infrastructure to support their data distribution and analysis. Data collected at CERN, the top tier (Tier-0), are distributed to a set of seven Tier-1 sites in as many countries. The U.S. CMS Tier-1 site at Fermilab further processes and distributes the data across the seven U.S. CMS Tier-2 sites, which in turn send datasets to tens of universities (Tier-3 sites) for physicists to access and analyze from anywhere in the world.



IN A DAY THE WORLDWIDE LHC COMPUTING GRID CAN MOVE UP TO 200 TERABYTES OF DATA